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UNITED STATES
DEPARTMENT OF THE INTERIOR
HAROLD L. ICKES, SECRETARY

BUREAU OF MINES
R. R. SAYERS, DIRECTOR

INFORMATION CIRCULAR

TENTATIVE COAL-MINE INSPECTION STANDARDS

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UNITED STATES DEPARTMENT OF THE INTERIOR - BUREAU OF MINES

TENTATIVE COAL-MINE INSPECTION STANDARDS[1/]

INTRODUCTION

These tentative coal mine inspection standards have been prepared as a guide for the Federal inspection of coal mines of the United States. Much time and thought have been spent by various members of the Safety Division in the preparation of thses standards, and it is believed that compliance with them eventually will be possible in most mines. In many instances objections will be raised to them owing to long-established mining customs and practices that are inherently of dubious safety and to a natural inclination to oppose change. In other instances there will be valid objections due to conditions not foreseen at the time these standards were prepared. Or there may be substandard conditions and practices due to original mine layouts that it is not practicable to change during the lifetime of the mine; in such instances it is likely that some effective measures are or can be taken toward lessening hazards.

With the rapid change in mining methods some of the standards may become inapplicable and it may be advisable to revise them to meet the new conditions. Therefore, questions regarding these standards and suggestions regarding new standards should be brought to the attention of the supervising engineer of the Coal Mine Inspection Division so that modifications of and additions to these standards may be made from time to time.

In many respects these standards exceed the provisions of the various State mining laws, and some may conflict with the laws of some States. In cases of conflict, the intent is not to advocate noncompliance with State laws but to suggest that it may be desirable for the State to reconsider such laws or safety orders.

Although an effort has been made to word these standards so that they may be readily understood, nevertheless, a reasonable interpretation should be placed upon them. In fact, in numerous instances the words "reasonable", "suitable", and "properly" are used in recognition of the fact that reason and sound judgment enter into the carrying out of the safety endeavor.

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The policy of the Bureau on some vitally important safety matters in mines is set forth in its published Safety Decisions. These decisions have been consulted and used in the preparation of these standards. These decisions also are now being reexamined by its Mine Safety Board.

SURFACE HAZARDS

1. General

1. All buildings within a radius of 100 feet of mine openings should be of fireproof or fire-resistant construction. If existing buildings within 100 feet of openings are not of fireproof or fire-resistant construction, fire doors should be erected at effective points where smoke or fire from outside sources may endanger men working underground. These doors should be tested for effectiveness at least every 3 months.

2. Adequate fire protection should be provided.

3. Fire hydrant couplings should be standard and interchangeable with municipal fire departments.

4. Fire-fighting equipment should be inspected and tested at least every 6 months and a record made of such inspections.

5. A fire-fighting organization should be maintained and fire drills held at least four times a year.

6. All surface buildings should be well illuminated, and heated where necessary.

7. Tight metal receptacles should be provided for oily waste.

8. Roads, paths, and walks should be kept free from obstructions, and should be well illuminated if used by night shift.

9. Timbers, ties, and other mine lumber, other than 1 day's supply, should not be kept within 100 feet of mine opening or mine fan, and all materials, including rails, scrap iron, and other scrap, should be properly stored and piled so they will not obstruct roadways, will not present a stumbling hazard, or cannot roll or fall.

10. Electric wiring in all surface buildings should be installed so as to present no fire or contact hazards.

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11. Wash houses should be provided and should be:

(a) Kept clean and sanitary.
(b) Provided with adequate toilet facilities.
(c) Provided with at least two exits.
(d) Well illuminated.
(e) Provided with clothes lockers or hangers.
(f) Kept well heated and if necessary, heating equipment guarded against contact hazard.
(g) Properly ventilated.
(h) Provided with adequate washing facilities.
(i) Provided with disinfectant foot bath in which the disinfectant is changed daily.

12. Supply houses:

(a) Material should be stored so that it will not fall or cause a stumbling hazard.
(b) Oil and grease should be stored in closed containers in a building separate from other materials.

13. Lamp house:

(a) Standard charging equipment should be used.
(b) Naphtha used for flame safety lamps should be stored in suitable containers, and only small amounts, preferably enough for 1 day's use, kept in lamp house.
(c) Only permissible flame safety lamps should be used.
(d) Flame safety lamps should be maintained by someone specifically assigned to that duty.
(e) Flame safety lamps should be properly cleaned, assembled and tested after each use. They should also be tested immediately before being taken underground.
(f) Charging equipment should be guarded and protected against shock hazard.

14. In handling railroad cars, brakemen should:

(a) Use suitable brake stick, preferably made of metal.
(b) Use safety belt.
(c) Wear safety hat.
(d) Use railroad type pinch-bar for shifting cars.
(e) Wear snug-fitting clothing.

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15. While engaged in repair work in or around shafts, safety belts should be worn by all workmen. When a platform is being used, a second, or safety platform, should be placed not more than 10 feet beneath the working platform.

2. Tipple or Cleaning Plant

1. Electric motors used in tipples and cleaning plants should be dustproof.

2. All switches and starting boxes should be enclosed.

3. Open stoves or open -type heating devices should not be used in tipples or cleaning plants.

4. Coal dust should be cleaned thoroughly and frequently (preferably daily and at least once a week) from floors and ledges.

5. In tipples having a dust hazard and in dry cleaning plants, an air exhaust system should be used with dust collecting hoods located at the principal sources of dust, or dust should be allayed with water or other wetting agent.

6. Where coal is dumped at or near the intake air shaft, provision should be made to prevent the dust from entering the intake air or the main workings.

7. Surface stairways should not be set on an angle of more than 45° with the horizontal.

8. All stairways should be provided with safe hand rails and kept in good repair.

9. The treads of stairways should be of nonslipping construction, uniform, and kept in good repair.

10. At least 6-1/2 feet of head clearance should be provided over stairs.

11. Permanent ladders should be properly guarded.

12. All floor openings should be properly guarded with toe boards and rails.

13. All passageways and places where men must work should be well illuminated.

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14. Men working around tipples or cleaning plants should wear goggles and, at dusty operations, they should wear suitable approved respirators.

15. Welding in tipples or cleaning plants should be done preferably when the plant is idle; in any event welding should not be done in a dusty atmosphere, and combustible surroundings should be wetted down before and after welding.

16. Where coal is treated with oil, men exposed to the oil mist should wear suitable approved respirators, and sources of ignition should be kept at safe distances from the oil spray.

3. Head Frame

1. A railed platform should be provided at head sheaves.

2- The stairway leading to the sheave platform should be provided with hand rail.

3. Sheaves should be inspected and oiled daily; they should not be operated during this procedure; a record should be made of this inspection. The oilman should advise the engineer in person when he has completed his job.

4. Machinery and Safety Appliances in connection therewith (Surface and Underground)

1. Machinery and belting should be guarded adequately as indicated below:

(a) All gears, sprockets, friction devices, and couplings with protruding bolts or nuts should be completely guarded.
(b) All shafting and shaft ends longer than 2 inches within 6 feet of floor or platform level, should be completely guarded.
(c) All vertical or inclined belts, chains, or rope drives should be suitably guarded to a height of 7 feet from the floor.
(d) Horizontal belts, chains, or ropes within 7 feet of floor or platform should be guarded.
(e) All fly wheels should be guarded. Where fly wheels are more than 6 feet high they should be guarded to a height of at least 6 feet.

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(f) All circular and band saws and planers should be adequately guarded.
(g) Locomotive pits should be properly guarded and guard kept in place when the pit is not in use.

2. Hand tools should be kept in good condition.

3. Goggles should be provided, and men required to wear them when using grinding tools and when doing other work where particles are likely to fly. Preferably all mine employees should wear goggles at all times in and around mines. Where corrective lens goggles are indicated, they should be provided.

4. Welders and helpers should be provided with proper shields to protect their eyes.

5. All electric machines should be grounded according to the National Electrical Safety Code.

6. All rheostats and electric heaters should be adequately spaced away from combustible material or effectively shielded to eliminate fire hazards.

7. Light circuits and stationary machines should have suitable switches or circuit-breakers for cutting off current, and should be placed where they may be reached without danger of contact with moving parts.

8. All grinding wheels should be equipped with safety washers and substantial retaining hoods.

9. All surface machines should be illuminated adequately and safely.

10. Adequate clearance should be provided at machine installations, and passageways kept clear of stumbling hazards.

11. Good housekeeping should be practiced.

5. Mine Refuse Disposal

1. Burning waste dumps should be so located with reference to mine openings as to present no fire or fume hazard.

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2. The waste dump should be fenced where there is a possible hazard to persons, especially children, or to animals.

3. Mine waste disposal that presents a fire or slide hazard should be so placed as not to endanger mine or camp.

6. Surface Haulage

1. Track and roadbed should be maintained in good condition.

2. There should be clearance of 30 inches or more on at least one side of tracks, but if it is not practicable to obtain such clearance at some places these places should be marked with warning sign of impaired clearance.

3. Frogs and guard rails should be blocked to prevent persons from catching feet in them.

4. Positive hand-operated or automatic track switches should be provided.

5. Track switches should be provided with parallel throws and the bar extending from the track to the switch throw should be installed in such manner as to eliminate stumbling hazard.

6. Outside planes or inclines should have:

(a) A positive stop block at the top.
(b) A derail near the top.
(c) A derail near the bottom.

7. An effective drag or equivalent positive mechanical device should be provided on all trips on mechanical or gravity planes or slopes.

8. Where surface operations require that many persons pass over the haulageway, a warning signal should be installed or an overhead walkway or underpass provided.

9. All track crossings should be provided with warning signs.

10. Crossings should be guarded while cars are being moved.

11. Derail devices should be installed on all side tracks near junctions with main lines.

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7. Hoisting Equipment

1. Hoisting engines should be placed so that noise of other machinery will not prevent the engineer from hearing signals.

2. Hoists should be equipped with brakes able to stop and to hold the fully loaded unbalanced cage or trip of cars at any point in the shaft or incline. Sole dependence should not be placed upon a friction brake for holding a cage or trip while men are being loaded or unloaded.

3. Hoisting engineers should be physically fit and should undergo a physical examination at least annually to determine their continued fitness, and physician's report of such examination should be posted.

4. Hoisting equipment should be inspected daily and a record made of such inspection.

5. The hoisting engine should be provided with positive overwind and overspeed devices.

6. At the beginning of each shift the hoisting engineer should slowly operate the cages up and down the shaft at least one round trip before hoisting or lowering men.

7. A second engineer should be in attendance at all times while men are being hoisted or lowered unless the hoist is equipped with automatic overwind and overspeed and automatic stop controls that are tested daily.

8. Drum guides or flanges should be high enough to extend at least 4 inches above rope at any time.

9. An accurate and reliable indicator of the cage or trip position should be so placed as to be in constant view of the engineer.

10. The rope should make at least three full laps on the drum when extended to its maximum distance and should make at least one full lap on the drum shaft and the end should be fastened securely by means of clamps.

11. The rope should be fastened to its load by a spelter-filled socket and bridle chains, or by a thimble and clamp and bridle chains, or other approved method.

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12. A rope should not be used for hoisting men:

(a) Which shows more than six broken wires in any single pitch length or lay of rope.
(b) When the wires in the crown of the strand are worn to less than 65 percent of their original diameter.
(c) When inspection indicates a dangerous amount of corrosion or distortion.

13. A record should be kept of the length of service and tonnage hoisted of all hoisting ropes, and ropes should be replaced as soon as there is evidence of undue weakness or other conditions which indicate that the rope may fail.

14. Ropes, links, chains, and rope sockets should be examined carefully at least every 24 hours by a competent person, and a written report made of such inspections.

15. When men are transported in cars on outside planes or inclines:

(a) Special provision should be made, in addition to the coupling, to insure against accident should the rope or the coupling of any car break or become detached, or should the drawbar of any car break.
(b) They should be provided with level seats and hand holds.
(c) No tools, explosives, or other material should be carried in cars with men in the same trip.

16. Rollers used on slopes or inclines should be of sufficient length, properly alined, and kept in good repair.

17. At least two independent methods of signaling in shafts should be provided, one of which should be audible.

18. Signal devices at surface and intermediate landings should be located so they may be reached from the cage.

19. The signal code in use at the mine should be posted prominently in the engine room in easy sight of the hoisting engineer, and at all places where signals are given.

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8. Cages and Shafts

1. Cages used for hoisting men should be of substantial construction, kept in good repair, and provided with:

(a) Adequate steel bonnets.
(b) Sides of cage fully enclosed.
(c) Gates across ends, removable, if desired, when men are not being hoisted.
(d) Hand holds.
(e) Bridle chains.

2. Safety catches that act quickly and effectively in an emergency should be provided, and they should be tested at least every 2 months and a written record kept of tests.

3. Cages and guides should be inspected daily and a record kept of such inspections.

4. Any opening in the cage floor should be covered when men are being hoisted.

5. There should be a cager in charge at top and bottom of shaft when men are being handled.

6. Shafts should be equipped at top and intermediate landings, if any, with safety gates. The gates should be so constructed that materials will not go through or under them and into the shaft.

7. A positive stop block or derail should be placed at surface and intermediate shaft landings.

8. Tools or other material should not be carried in the cage with men. However, this should not apply to equipment and repair material requiring attendants.

9. Speed of cage when hoisting or lowering men should not exceed 900 feet per minute, or maximum speed specified by State law.

9. Steam Plant

1. Boilers should not be located less than 100 feet from any mine opening.

2. All boilers and stationary compressors should receive at least one internal inspection annually by an authorized inspector and a written record of such inspection should be kept.

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3. A safety valve escape or blow-off should not discharge lower than 7 feet off the floor and preferably the discharge should be piped to the outside of the building.

4. At least two safe means of exit from all parts of the boiler room should be available.

5. A stairway or fixed ladder should be provided to give easy access to the top of boilers or runways between boilers.

6. Compressors should be equipped with a fusible plug that will open at a temperature of 50° less than the flash point of the lubricating oil in use. This plug should be placed in the main discharge line as near the compressor as possible.

7. The main compressed air receiver should be equipped with safety or relief valve or valves.

8. Suitable gages should be provided for boilers and compressors (steam pressure, air pressure, water, etc.).

10. Surface Electric Material

1. Overhead transmission lines should be placed at least 15 feet above the ground and 20 feet above driveways and should be supported and guarded adequately to prevent contact with other circuits.

2. High potential power lines should be protected adequately by circuit breakers.

3. The wires of all circuits should be of ample capacity for the current carried.

4. Trolley wires should be kept at least 6-1/2 feet above the top of the rail and should be guarded at all regularly provided crossings. Wires 8 feet or higher above the rail need not be guarded.

5. Trolley wires should be taut, securely supported by enough insulated hangers to prevent sag, and placed at least 6 inches outside of one rail.

6. Transformers within 15 feet of the ground should be enclosed in a transformer house or by a substantial fence at least 6 feet high.

7. The gate or door to transformer station or fence should be kept locked at all times unless authorized persons are present.

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8. DANGER-HIGH VOLTAGE signs should be placed on all transformer enclosures and high-tension switchboards.

9. Casings of all transformers should be grounded by the equivalent of No. 0 copper wire.

10. Switchboards should:

(a) Have ample working space around and back of them, free of rubbish and stored material.
(b) Have entrance at each end to permit authorized persons to inspect, adjust, or repair apparatus back of switchboard.
(c) Be adequately lighted.
(d) Have control readily accessible for emergency shutdown.
(e) Have cut-out switch on incoming circuit at or near entrance to rear.

11. Frames of all generators, motors, and switchboards, and metallic casings of cables carrying more than 300 volts should be grounded by the equivalent of No. 0 copper wire.

12. Dry wood platforms or mats of rubber or other electrically nonconducting material should be kept in place in front of all switchboards and at all electrical machinery where electric contact hazards exist.

13. Wires or other substitutes that do not provide adequate protection should not be used in place of approved fuses.

14. Guy wires from poles supporting wiring carrying high tension current should be efficiently grounded, and insulated between the ground and poles, near the poles.

15. Fire extinguishers approved for electrical fires should be available at all electric installations.

11. Surface Explosives

1. Surface explosives storage magazines should be:

(a) Constructed of incombustible material.

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(b) Barricaded and located a safe distance from the nearest building, highway, or mine entrance. (Refer to American Table of Distances.)
(c) Located a safe distance from waste dumps.
(d) Suitable danger signs nearby.
(e) Provided with properly screened ventilators.
(f) Kept locked securely at all times when not being used.

2. If the explosives magazine is illuminated electrically, the lamps should be of vapor-proof type, the switch should be located outside the building, and wiring should be in conduit.

3. The area for at least 100 feet around the magazine should be kept free of dry grass and brush or other combustible material. Preferably, the ground around the magazine should be covered with cinders or gravel to prevent growth of grass.

4. Detonators should be stored in a separate magazine of incombustible material not less than 100 feet from the explosives storage magazine.

5. No material other than explosives should be stored in explosives magazines.

6. No material other than detonators should be stored in detonator magazines.

7. Magazines for distributing explosives should be constructed of incombustible material and situated a safe distance from the mine opening and other buildings, in accord with American Table of Distances. Preferably, they should be surrounded by a substantial fence which has a locked gate.

8. No more than 1 day's supply of explosives should be kept in the distributing magazine.

9. Unauthorized persons should not be permitted in the distributing magazine.

10. Only hardwood or nonsparking plastic tools should be used for opening boxes of explosives.

11. Waste paper and empty boxes should not be allowed to accumulate in storage or distributing explosives or detonator magazines.

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12. No open lights, nonpermissible flashlights, or smoking should be allowed in storage or distributing magazines or in the handling of explosives or detonators.

13. Cases or kegs of explosives should always be lifted and set down carefully, never slid over one another nor dropped from one level to another.

14. Any motor vehicle or other vehicle used in surface transportation of explosives should be strong, substantial, and in good working order, preferably with a closed body with ends and sides high enough to prevent packages of explosives from falling or rolling off.

15. The batteries and wiring on motor vehicles used in hauling explosives on the surface should be located so as not to come in contact with packages of explosives, and wiring should be well insulated and fastened to prevent short-circuiting and fire.

16. State or other regulations as to marking explosives transporting equipment should be complied with. If no laws or regulations are in effect such vehicles should be placarded on each side and rear with the word EXPLOSIVES in letters not less than 3 inches high or should display a red flag with the word DANGER in white letters not less than 6 inches high.

17. Unauthorized persons should not be permitted to ride on equipment transporting explosives and the driver and helper should not smoke, or carry matches or lighters.

18. A truck or other vehicle containing explosives should never be left without first stopping the motor and setting the brakes securely and should never be taken into a garage or repair shop.

19. Explosives transported in a truck should never be left unattended until they are placed in a magazine and the magazine is locked, or are delivered to someone authorized to receive them.

20. Before unloading explosives from a truck the motor should be stopped, and the packages should never be left immediately back of the exhaust as a spark may start a fire and cause an explosion.

21. Explosives should not be issued by company stores or otherwise to wives or children of miners or carried or otherwise handled by women or children.

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22. Explosives should not be stored (even temporarily) in merchandising stores, in or near miners' homes, or in hoist rooms or other miscellaneous surface structures.

UNDERGROUND

NOTE: Wherever certified officials, such as certified shot firers, are mentioned in these standards, officials certified by the State are meant. If the State has no certification for such officials, they should be men well versed in the duties of their positions, through mining experience and training, and such positions should be designated in writing by the management. In the interest of safety, the Bureau of Mines believes that all mining States should require certification of mine officials.

12. General Practice

1. Air courses and accessible falls should be traveled at least once each week by a certified mine official, who should leave his initials and the date; if the air course is in such condition in any part or parts that it cannot be traveled, the defective condition or conditions should be remedied promptly.

2. Entrance to dangerous places should be fenced off, and a suitable danger sign placed.

3. A statement of all dangerous conditions should be recorded daily in a book signed and dated by the mine foreman, and countersigned by the superintendent.

4. Each working place should be inspected for safety by a certified official at least twice each working shift and at such more frequent periods as seem necessary and practicable. He should leave at or near the face of each place examined his initial and date.

5. Special company rules regarding mine safety should be adopted and published; they should be approved by the State agency governing mining where such approval can be obtained.

6. New employees should be fully instructed regarding the company safety rules and regarding the particular hazards incident to their work; this applies to both experienced and inexperienced personnel.

7. New employees should be furnished with a copy of the mine safety rules.

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8. Employees should become conversant with the Mining Law with the aid of such instruction and assistance as may be obtained from the company or available educational agency.

9. The map of the mine should be brought up to date at least every 6 months and posted in a convenient place accessible to employees.

10. The map posted at the mine should show in addition to the mine workings:

(a) The direction of air currents passing through main headings, cross headings, and working places should be shown by arrows in colors.
(b) Locations of doors, overcasts, and regulators.
(c) Locations of telephones, power and trolley lines, and permanent electrical equipment.

11. The map should accurately show the thickness of barrier pillars around the boundary of the property.

12. When approaching abandoned workings which cannot be inspected or workings filled with water or gas, boreholes should be kept at least 20 feet in advance of the face, and similar 45° angle holes 25 feet deep in each side.

13. Machinemen, drillers, and loading machine operators (so far as possible) should not permit others near their machines while in operation.

14. At least two permissible flame safety lamps should be kept in proper working condition at every coal mine and at least two persons should be kept well informed as to the safe maintenance, testing, and use of flame safety lamps.

15. Drift or slope openings at the surface should be at least fifty (50) feet apart.

16. Protective hats should be worn by all employees, officials, and others while on duty in all parts of mines and also in work around mines where there is danger from falling objects.

17. Protective footwear should be worn by employees, officials, and others while on duty in and around mines.

18. Goggles should be worn, preferably at all times, by the men while they are on duty in and around mines, or at any rate while they are grinding, cutting, welding, and striking where particles are likely to fly.

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19. Gloves should be worn when material is handled that may injure the hands. Gloves with long cuffs should not be worn unless material is being handled that may injure wrists, in which case the cuffs should be tight fitting.

20. Haulagemen and others who work around machinery should wear tight-fitting clothing and have trouser legs held with boots, puttees, tucked inside socks, or otherwise fastened.

21. The foreman or other person in charge of underground operations, and all assistant foremen should have a certificate of competency from the State if the State issues such certificates.

22. A record of foremen's certificates should be kept at the mine.

23. Fire bosses, shot firers, drillers, cutting machine and mechanical loader operators should have a certificate of competency from the State department of mines if the State issues such certificates.

24. Idle or abandoned sections of the mine should be inspected for gas and other dangerous conditions by foreman or fire boss immediately before other employees are permitted to enter these sections.

25. Every underground mine should have not less than two openings or outlets to the surface that are connected with every seam of coal and from every lift and level thereof worked in such mine, except that it is not necessary that the two openings belong to the same mine if they afford safe escape or travel through either opening from either mine. However, such statement does not apply to opening new mines or new parts of mines in which not to exceed 20 persons should be employed on any one shift and that for the purpose of making a second opening.

26. Main slope and drift escapeways to the surface should be separated by at least 50 feet of natural ground throughout their length.

27. Escapeways should be readily accessible from every section of the mine and should be kept in a safe condition reasonably free from steam, dangerous gases, standing water, ice, and other obstructions.

28. Escapeways should be of sufficient height and width to allow men to travel safely.

29. Direction signs should be posted conspicuously to indicate manways and escapeways.

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30. Where the escapeways are shafts:

(a) They should have incombustible walls or lining and be free of fire hazard from surface to bottom.
(b) They should be equipped with an independent hoist and cage, or with a travelable stairway.
(c) If equipped with stairway, it should be of substantial construction, set at an angle not greater than 45° with the horizontal, and equipped on at least one side with standard hand rail; landing platforms should be at least 2 feet wide and 4 feet long at easy and convenient distances (preferably not over 30 feet), and should be railed properly.
(d) If the shafts are not more than 30 feet deep, a ladder may be used in lieu of a stairway. Such ladders should be fastened securely and guarded properly. The rungs should be fastened securely, spaced equally, and not over 15 inches apart.

(e) Ladders or stairways should be kept in good repair with landings free of debris.

31. Where the escapeway is a slope of over 30°, it should be equipped with stairway or ladder, with landings at not to exceed 50-foot intervals.

32. Where the way of escape is a drift or slope which is inclined less than 45° from the horizontal, the incombustible walls, or lining, and freedom from fire hazard shall extend at least 200 feet from the entrance. Other escapeways also should have incombustible walls or be made fire resistant for 200 feet from the entrance or have incombustible walls and lining for 25 feet and fire doors. Fire doors should close automatically upon the release of a wire or rope.

33. When but one way of escape has incombustible walls or lining, it should be the normal intake airway.

34. All surface openings to underground workings that are not necessary for the operation of the mine or for escape and are not adequately ventilated, timbered, and regularly inspected, should be kept securely closed to prevent unauthorized persons entering and surface fires from extending underground, but they should be locked in such a way as not to prevent the escape of employees in an emergency.

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35. All openings necessary for operation or escape should be guarded against the entrance of unauthorized persons.

36. A check-in-and-out system should be provided. In any event, identification checks should be provided that will positively identify each person entering the mine. The daily record in connection with the system should be kept in a place that will not be affected by an explosion in the mine.

37. All shaft linings should be fireproof and, so far as feasible, they should be smooth and without projections or recesses.

38. Oil and gas wells penetrating strata below beds of coal should be protected by a pillar of coal extending at least 50 feet on every side of the well bore.

39. If oil or gas wells penetrate open workings:

(a) A surrounding wall or pier of cement, masonry, or concrete should be constructed of a diameter exceeding the height of excavation, or at least 48 inches.
(b) The casing should be surrounded by an outer steel casing extending 20 to 30 feet below the coal bed, and open to the outside atmosphere for relief of any gas liberated.

40. Every oil or gas well that penetrates coal beds should be plugged properly with concrete for at least 10 feet above and below the coal bed when abandoned and the record filed with the State mining department.

41. All oil and gas wells should be indicated accurately on the mine map.

42. A 50-foot barrier pillar, or larger if deemed necessary, should be left when workings are adjacent to old workings suspected of containing bodies of dangerous gas. If the danger is from water the barrier pillar should be of such width as is determined by qualified engineers and approved by the proper State agency.

43. Strict compliance with mining laws and company safety standards should be demanded of all employees.

44. Machinery should not be repaired while it is in motion or oiled while it is in motion, except where such oiling can be done without danger to the oiler.

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45. A guard or safety device removed from any machine should be replaced before the machine is put in operation.

46. An adequate supply and variety of tools should be available in working places, and these should be maintained in good condition.

47. Cutting machine, or mobile loader helpers, should travel at least 50 feet in advance of the machine going out of a working place onto haulageway and when traveling on haulage entries, or other precautions should be taken to avoid collisions.

48. Mining machines should not be loaded on their trucks or moved unless they are equipped with a safety chain or other adequate locking device.

49. Permissible electric cap lamps should be carried by all underground employees.

50. Not more than 2 day's supply of each kind of lubricating oil and grease should be stored at any one place in the mine at any one time.

51. Underground storage places for lubricating oil and grease should be of fireproof construction. Lubricating oil and grease in face regions or other working locations should be in closed metal containers.

52. Inside structures (substations, shanties, stables, pump rooms, etc.) should be constructed of incombustible material. Where the incombustible material is in contact with timber or coal it should not be of metal.

53. Underground stables should be constructed of incombustible material and be provided with steel fire doors at entrances.

54. Hay or straw should be stored in a fireproof structure apart from the stable.

55. Underground stables should be ventilated by separate splits of air, with vent to the return air course.

56. A separate run-around or passageway should be provided for travel at the foot of shafts and all intermediate landings. The run-around should not be less than 5 feet high and 3 feet wide.

57. At the foot of each slope there should be a refuge hole at least 10 feet deep, 4 feet wide, and 6 feet high.

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58. The eyes of fire bosses, machinemen, mechanical loader operators, shot firers, and others who are required to test for gas should be in good condition or fitted with corrective-lens glasses.

59. To prevent injury from side slip of caterpillars from rail, the operator of caterpillar machine, when moving from place to place, should ride on the step provided for that purpose.

60. Barrier gates which close automatically should be provided on manways where they cross haulageways.

61. Pillar workings should be examined for explosive gas and other dangers before a cave or fill is made, and if gas is found in amounts that can be detected with a permissible flame safety lamp the cave or fill should not be made until gas is removed or, if removal of gas is not practicable, other precautions should be taken to safeguard all employees.

62. Drilling rock with percussion drills should be done wet. Men drilling rock with auger-type drills should wear approved type of respirators if dust is produced.

63. If axes are used underground, the handles should not be over 18 inches in length.

64. In coal beds pitching over 30°, a pillar of suitable thickness should be left below each level or gangway to be maintained.

65. Welding underground should be done in pure intake air, except that if welding is deemed necessary in return air, a certified official should be part of the welding crew and no welding should be done if methane is present in quantity of more than one-half percent. Especial precautions should be taken against the starting of a fire, particularly when the welding is done in a shaft or on the surface about the shaft collar.

13. Ventilation

1. Main fans should be:

   (a) Installed on the surface.
   (b) In a fireproof housing.
   (c) Offset at least 25 feet from the line of any opening.
   (d) Provided with ample pressure relief or explosion doors.
   (e) Installed to permit prompt reversal of air flow.
   (f) Provided with at least two independent sources of power immediately applicable, or a secondary fan unit if mine is gassy.

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(g) Operated continuously, except when mine is shut down.
(h) Provided with pressure recording gage.
(i) Provided with device to give alarm and cut off power automatically from mine when the fan slows down or stops.

2. Ventilating fans at isolated locations should be:

(a) Inspected daily.
(b) Attended constantly if not provided with automatic signal alarm and with remote control.

3. The area around fans, especially in isolated places, should be kept free of dry grass and brush or other combustible material for at least 100 feet.

4. Ventilating fans should be located so the return air from the mine cannot be pulled into the intake openings.

5. An auxiliary fan, preferably operated by an internal combustion or steam engine, should be provided when feasible, to serve in event of failure of the main fan.

6. A mine should be classed as gassy when methane or other combustible gas can be detected in amounts of as much as 0.25 percent or more by frequent, systematic search.

7. Intake air should be brought into the mine through a separate opening and not in an opening carrying both intake and return air separated by a partition.

8. Booster fans should not be used underground to increase the pressure on part of the total air flow.

9. Auxiliary fans or blowers with tubing should not be used in coal mines, except that they may be used to ventilate faces of rock tunnels being driven between two coal beds or through faults and wants. However, if used, they should be powered with permissible driving units and so located that recirculation of air is impossible.

10. Air in working places or travelingways should contain at least 20 percent oxygen, not more than 0.5 percent carbon dioxide, and no harmful amount of dust or poisonous gas.

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11. If the air of a working place contains more than 1 percent of inflammable gas, the place should be considered hazardous and to require improved ventilation immediately; if it contains more than 2 percent (slightly less than 1/2-inch cap on a testing or low flame), the workers should be withdrawn until ventilation has been improved.

12. If the air immediately returning from a split that ventilates any group of active workings contains more than 1/2 percent of inflammable gas, as determined by chemical analyses in duplicate or by other recognized means of accurate detection, the workings of that split shall be considered hazardous and require improved ventilation. If this air contains more than 1-1/2 percent of inflammable gas, the workers should be withdrawn until ventilation has been improved.

13. The quantity in cubic feet per minute of pure air in any split, circulated through the last open crosscut, should be not less than 200 times the number of men working in the section, and as much more as may be required.

14. The quantity of air reaching the last open crosscut on any pair of working entries, headings, or gangways, or the maximum inby point of a split should be at least 6,000 cubic feet per minute.

15. The quantity of air reaching the face of each working place should be at least 200 cubic feet per minute per man employed and as much more as may be necessary to dilute and carry away any inflammable or harmful gases that may be present.

16. All entries, rooms, panels, or sections that cannot be kept well ventilated throughout and regularly inspected, or that are not being used for coursing the air, travel, haulage, or the extraction of coal, should be sealed by strong, fireproof stoppings and provided with some means of bleeding-off the gas into the return.

17. Ventilation should not be shifted from idle or abandoned sections to active sections to provide an adequate quantity of air for different working shifts.

18. Break-throughs should be made not more than 80 feet apart.

19. Stoppings between intake and return of all main haulageways should be constructed of substantial incombustible material except that one temporary stopping of wood or brattice cloth may be erected between the last permanent stopping and the face of entries. These stoppings should be completed promptly as the passageways are advanced. On branch haulageways stoppings should be of substantial construction and of incombustible or fire-resistant material with the exception near face as above.

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20. Stoppings in room crosscuts should be of gob wall, dirt, or tight board, preferably gunited or plastered, except that canvas may be used in the last open crosscut in connection with line brattice.

21. Not more than one crosscut should be left open between the faces of entries and the first outby temporary or permanent stopping.

22. A split ventilation system utilizing air crossings should be used instead of doors for conducting ventilation in all main passageways.

23. Where doors are used in connection with coursing the air in any one split or if used in lieu of a split ventilation system they should be:

(a) Installed in pairs to form air locks or, where this is not feasible, tight check curtains, well-maintained, should be hung in connection with single doors.
(b) Self-closing.
(c) Not provided with latches or other devices to hold them open.
(d) Provided with a small glass or clear plastic window, except that when check curtains are used in connection with haulage through single doors an automatic signal should be provided to give positive evidence when door is open.
(e) Provided with a supply of rock dust on each side for fire emergency use if doors are of wood.
(f) Hung so that they swing to the clearance side.
(g) Hung so as to open against the ventilating current.

24. Overcasts should be tight and of noncombustible material and should be so arranged as to pass the required quantity of air.

25. Trap-doors placed in stoppings should be so hinged or constructed as to be self-closing, tight, and open against the air current.

26. Line brattice should be:

(a) Used to conduct the air from the last open breakthrough to working faces when necessary to remove gases, explosives fumes, and smoke and dust.
(b) Constructed with boards at bottom and otherwise secured to provide the most adequate air movement possible and convey sufficient ventilation to the face.
(c) Be of mildew- and fire-resisting material.

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27. The space on the intake side of line brattices should be large enough (approximately 3 feet in width) to permit free flow of air and this space should be kept clean; posts should be on the wide side of the brattice, and the space on the return side should also permit free flow of air.

28. Rooms, chambers, breasts, or chutes should not be worked off an entry heading or gangway in advance of the last break-through, even if line brattices are utilized. This does not apply to the driving of such places to make a connection at the first crosscut, counter, monkey drift, or similar passageway used as a main airway in connection with a gangway or entry. It does apply to extending such places beyond the airway before the main intake and return passageways are connected ahead of the room, chamber, breast, or chute.

29. Places should not be worked on an air current that has passed through abandoned workings or pillar lines that cannot be inspected regularly. It is hazardous to work in places using air currents from partly caved workings.

30. Airways should be kept clear to permit free passage of air; this includes nonhaulage aircourses as well as those utilized for haulage or man-travel.

31. Changes in ventilation affecting the mine as a whole or splits thereof should be made when the mine is idle and with no men in the mine other than those engaged in changing the ventilation.

32. Should the main fan fail or stop for 5 minutes or more in a gassy mine (gassy mine being defined by Bureau of Mines Safety Decision 33) the men should be withdrawn immediately from the mine. After the fan has been started the mine should be examined thoroughly for gas and any gas found should be removed before the men re-enter. The same procedure should be followed in a section of a gassy mine if it is ventilated by a booster fan and there has been more than momentary stoppage of such fan.

33. Should the main fan of a nongassy mine (mine in which frequent systematic searches find less than 0.25 percent of methane as per Safety Decision 33) fail or stop for more than 30 minutes the men should be withdrawn immediately from the mine. After the fan has been started the mine should be examined thoroughly for gas and any gas found should be removed before men re-enter.

34. If stoppage of main fan is more than momentary, mine electrical power should be cut off from face sections and if stoppage is for 5 minutes or more power should be cut off from the entire mine. A thorough gas examination should be made before power is restored.

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35. Permissible methane detectors should be used for making inspections for explosive gas. Permissible flame safety lamps are considered a type of permissible methane detector.

36. When not in service, all methane indicators or detectors and flame safety lamps should be placed in the custody of a competent person responsible for their maintenance and testing.

37. All men required to use methane indicating devices or flame safety lamps should be thoroughly instructed in their use and limitations.

38. All coal mines classed as nongassy should be carefully inspected for methane at least once a month.

39. Enough firebosses should be employed in gassy mines; they should:

(a) Begin examination of the mine not more than 3 hours before each shift enters the mine.
(b) Examine every working place, all places adjacent to live workings, every roadway and travelway, every unfenced road to abandoned workings, and all accessible falls in the mine for explosive gas and other hazards.
(c) Leave at or very close to the face of each place examined his initials and the date.
(d) Place a danger signal across the entrances to every place where explosive gas can be detected by a flame safety lamp or where other danger is found.
(e) Report to the foreman any dangers found before the men enter the mine.
(f) Record the result of his inspection in a book kept on the surface for that purpose.
(g) Indicate on a bulletin board near the mine entrance the places where gas was found or other dangerous conditions were observed.

40. No electrically driven permissible equipment should be taken into or operated in any place if methane can be found by a flame safety lamp or permissible methane detector in amount of more than 2.00 percent in the general air of the place. Such test for methane should be made not nearer than 4 feet from the face and 10 inches from the roof.

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41. No electrically driven machine operating in face regions in a gassy mine should run more than 30 minutes without an examination for gas being made; in very gassy places or those in disturbed strata such as during a squeeze, the gas examinations should be spaced not more than 15 minutes apart.

42. Haulage and hoisting openings and main haulageways should be kept on intake air.

43. In very sealed area one or more stoppings should be fitted with pipe and valve to allow sampling of air behind seals. Relief of excess pressure should be made through pipes leading into the return or this pressure relief may be secured by boreholes to the surface.

44. The mine foreman or his designated assistant on each shift should read and countersign the fire boss' reports of examination preliminary to that shift before men enter the mine. The mine foreman should read and countersign daily the assistant foreman and fire boss' reports.

45. Air measurements should be made by the mine foreman, his assistants, or other certified official, at least once each week at or near the mouth of the main intake and return of the mine and also in or immediately adjacent to the last crosscut on each air split. Tests should be made with flame safety lamp or other methane indicator in such splits and in the main return. A record of these measurements and tests should be kept in a book furnished for this purpose.

46. Smoking should not be permitted in any mine.

47. Search of employees for smoking material, matches, and other lighting devices should be made frequently and in a manner to assure that such articles are not being carried into the mine.

48. Accumulations of gas should be removed under the direct supervision of a foreman or other competent official, and men should not work and nonpermissible electrical equipment should not be operated, on the return of the split while gas is being removed.

49. When electric power has been off a mine or section for 4 hours or more, the mine or section should be examined for gas, and if gas is detected the power should not be turned on again until the gas has been removed. However, this is not intended to bar operation of a single unit such as a pump on a properly fused branch line if examination has been made with flame safety lamp and no gas is found at pump surroundings.

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14. Explosives and Blasting Devices

1. Receptacles or boxes used to carry explosives into mines should be closed and constructed substantially of nonconductive material.

2. Bodies of cars used for transporting explosives underground should be designed for that purpose and constructed substantially of nonconductive material, and should be fully insulated, including the couplings.

3. Where feasible, the supply of explosives should be delevered on the off shift or between shifts.

4. Explosives should not be carried on the same trip with workmen.

5. Trips carrying explosives should not be operated at the same time man-trips are operated.

6. Explosives and detonators should be transported and kept in separate containers.

7. Explosives and detonators for use at working faces should be stored in individual containers in niches in the rib not less than 15 feet apart and at least 100 feet back from the working face; not more than one day's supply should be stored in these locations. In pillar or stump work or in places where it is not practicable to cut niches in the rib for storage of explosives, the foreman should designate safe places where explosives may be stored.

8. If underground storage boxes or magazines are provided, they should be:

(a) Placed in a crosscut or abandoned room neck as far away from the roadway as possible and at least 25 feet from trolley or power wires, and in a comparatively dry place.
(b) Kept locked at all times except when in use.
(c) Protected from falls of roof.
(d) Constructed substantially and, if of metal, with electrically nonconducting lining.

9. No more than a 24-hours' supply of explosives or detonators, including any surplus remaining from the previous day, should be stored underground. To avoid deterioration of explosives the older explosives should be used first so that none of the explosives in storage shall be in the mine more than 24 hours before firing use.

10. Only permissible explosives or permissible blasting devices should be used, and these should be used in a permissible manner as follows:

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(a) Not more than 1-1/2 pounds in any one shot.
(b) Fired only with electric detonators of proper strength.
(c) Fired with a permissible shot-firing device.
(d) Shall not be fired on the solid.
(e) Stemmed with incombustible material.

However, in anthracite mines where it is not feasible to cut or shear the coal and, therefore, uneconomical to break the coal with a limit charge of 1-1/2 pounds to any one shot, permissible explosives should be used owing to the greater factor of safety it affords compared with other types of explosives.

11. Shots should be charged and fired by certified shot firers, other certified officials, or authorized persons.

12. If the coal is cut, boreholes should not be drilled until after the undercut, topcut, or shear is made.

13. Boreholes should be drilled at least 6 inches less than the depth of the cut or shear.

14. Boreholes should be cleaned properly before the charge is placed in the hole.

15. Shot firers should refuse to charge or fire improperly placed holes.

16. Dependent shots or shots having insufficient or excessive burden should not be fired.

17. Explosives should not be brought to the face while any electrical equipment is in operation at or near the face.

18. Each primer should be made up at or near the face immediately before loading and in a place removed from wiring and rails.

19. Explosives should be tamped tightly with clay or other incombustible stemming, preferably to the collar of the hole, but in no instance should the stemming be less than 2 feet in length.

Also, in anthracite mines stemming can be construed to mean any type of plug used in lieu of stemming when the use of same does not deduct from the breaking efficiency of the explosive, create a harmful amount of noxious gases, or permit a blown-out shot.

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20. Only wood tamping bars, wood tamping bars tipped with hard rubber, or hard rubber bars should be used.

21. Leg wires of electric blasting caps should be kept shunted until ready to connect to the firing cable.

22. A blasting cable should be:

(a) At least 100 feet long.
(b) Kept shunted at the blasting end until ready to attach to the blasting unit, or otherwise protected from stray currents and electrically energized agencies.
(c) Wound up after each shot or adequately supported on timbers or rib.
(d) Kept away from track, power wires, pipe lines, or other possible sources of active or stray currents.

23. Bare spots on a blasting cable should be insulated properly as soon as observed.

24. The firing ends of a blasting cable should be staggered as to length.

25. Only permissible firing devices should be used unless blasting is being done from the outside with all men out of the mine: Provided, that in anthracite mines, other than permissible firing devices may be used in rock tunnels, rock crosscuts, and rock chutes if methane is not present in hazardous amounts.

26. Shots should not be fired from the power or signal circuit while any men are in the mine.

27. A shot should not be fired when more than 1 percent of methane is known to be present.

28. Roof and face of working places should be tested before, and the roof should be tested and the place examined for fire after, firing a shot.

29. The simultaneous firing of several shots with men in the mine should be allowed only if blasting is done entirely in a permissible manner, that is, with a permissible firing device, limitation of 1-1/2 pounds of explosive to the shot, and shots not dependent, etc.

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30. Shots should be fired promptly after charging.

31. Shots should not be fired in rapid succession, except that delay detonators may be used in anthracite mines.

32. Examination for gas should be made before and after firing a shot or simultaneous shots in a gassy mine.

33. Misfires should be handled under the supervision of a certified official.

34. Misfires due to defective detonators or defective leg wires within the hole should be handled by firing a separate shot at least 2 feet away from and parallel to the misfire, or by carefully washing any stemming out of the hole with a hose and inserting new primer. If a separate shot is fired careful search should be directed toward recovery of undetonated explosive and detonator.

35. Adobe (mudcap) or other open, unconfined shots should not be fired in any bituminous or lignite coal mine.

In anthracite mines adobe or other open, unconfined shots may be fired to start running of coal in chutes but only if it is not possible to start the coal running otherwise and there is no gas or fire hazard. Permissible explosives only should be used in such shots.

36. Ample warning should be given before shots are fired; this applies to Cardox and Airdox blasting as well as to the ordinary types of explosives.

37. An accurate record should be kept of:

(a) The amount of explosives and detonators taken into and returned from the mine.
(b) The number of misfired shots.
(c) The number of blown-out shots.
(d) Any holes the shot firer refuses to charge or fire.
(e) The total number of shots fired, including misfired, blown-out, or burned-out shots.

38. Undercut, topcut, and shear should be reasonably free of machine cuttings and escess water before shooting.

39. Cardox charging stations should:

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(a) Be located in a fireproof structure on the surface.
(b) Be located a safe distance from other structures.
(c) Have all equipment properly grounded.
(d) Have storage tank located outside the building.
(e) Be provided with at least two methods of relieving excess pressure in the storage tank. If one of these methods is a valve, the valve should be tested monthly.
(f) Have heating elements stored in a separate magazine on the surface. The magazine should comply with requirements for storage of other explosives.

40. Cardox shells should be transported underground in insulated cars or in insulated boxes placed in ordinary mine cars.

41. A well-insulated wire should be used for the connection to the insulated or "hot" terminal of a Cardox shell. A new piece of wire should be used for the connection of each blast; the wire may be used a second time for the grounded connection of the shell.

42. The ends of Cardox shell wires should be "shorted" before the "hot" wire is attached, and should not be untwisted until ready to attach the shooting cable.

43. Cardox shells should be wired at the working face only and never when leaning against a drill truck or other machinery.

44. Cardox should not be shot off the solid or in a "tight" shot.

45. All Cardox shots should be stemmed to the collar of the hole.

46. Everyone should be in a safe place, preferably around more than one corner, before shooting Cardox.

47. In the use of both Cardox and Airdox after the coal in a working place has been broken down examinations should be made for loose or dangerous roof by a certified official. In the case of a gassy mine a certified official should also examine for gas.

The following 18 recommendations apply to the use of Airdox:

(1) When installed on the surface airdox compressors should be in a separate fireproof building. Underground compressor stations for Airdox, as far as fireproof housing and ventilation requirements are concerned, should conform to previous recommendations in these Standards.

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(2) Compressor motor should be protected with proper compensated starting and overload relays.

(3) Compressed air should be conducted from compressor to within practical working distance of the face by steel tubing tested to a pressure of 20,000 pounds per square inch.

(4) As far as practicable steel air tubing should not be installed in haulage or other regularly traveled entries.

(5) All air lines should be grounded properly.

(6) Suitable unions should be installed on all lines of steel tubing at not less than 400-foot intervals.

(7) A cutoff valve should be installed in all branch lines close to main air line and also at inby end of all steel air lines.

(8) No air lines, either steel or copper, should be handled or repaired while air pressure is in the line.

(9) All copper air lines should be equipped with shutoff valves.

(10) Shooting or release valves should not be less than 45 feet from the face and should be located around at least one 90° angle corner with the center line of place in which coal is being broken down.

(11) After the breaking down of coal in any one place has been completed the shell should be disconnected immediately from the air line.

(12) When release valve is opened to discharge shell it should remain open until ready to charge shell in next hole.

(13) Dust in drill holes should be removed by washing out with water.

(14) When shooting coal, holes should not be drilled on the solid or in the roof. The shell should be pushed to the back of the drill hole, then withdrawn far enough to form an air cushion.

(15) When a break-through or crosscut is being made all men in the place to which such break-through or crosscut is being driven should be removed a safe distance from the working face before Airdox is released.

(16) When the pillar between working places is less than ten (10) feet in thickness all men must be removed a safe distance from the face of adjoining working place before Airdox is released.

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(17) Steel or copper air tubing should be insulated with a suitable insulating material when crossing trolley or other electric wires or when crossing under rails.

(18) All pressure tanks and lines should be blown out at least once a week, or more often if necessary to prevent any accumulations of oil or moisture.

15. Electricity Underground

1. Air in which nonpermissible mining equipment and electrical wiring is used should not contain more than 1/2 of 1 percent methane as determined by analysis or other recognized means of accurate detection of methane. In addition, such equipment and wiring should not be used in air from areas that might liberate dangerous explosive gas. Also if methane can be found in excess of 2 percent in holes in the roof of any working place by analysis or by methane indicator (flame safety lamp or electrical indicator) nonpermissible electrical equipment should not be taken into or operated in the working place until the pocket of gas has been removed by additional ventilation.

2. Permissible equipment should be maintained in good state of repair and in permissible condition, as determined by a rigid examination each week by a person well informed in the safe use of electricity underground and in the maintenance of equipment; a record should be kept of the defects found and how they were remedied. Repairs should not be made, nor the electrical parts opened at or near the face, while the power is on the machine or cable.

3. All electrical appliances, machines, and conductors should be sufficient in size and power for the work they may be called upon to do.

4. All metallic coverings and armor of cables should be continuous electrically and should be grounded effectively.

5. All metallic frames, casings, and coverings of motors, generators, transformers, switchboards, and other stationary equipment that can become "alive" through failure of insulation or by contact with live parts, should be grounded permanently and effectively.

6. Where a grounded return system is used, all underground metallic pipe lines 1,000 feet in length or over, and all metallic pipe lines leading outside the mine, should be bonded to the return at the ends and also at intervals not exceeding 500 feet.

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7. All metallic pipe lines and conduits in shafts and boreholes should be grounded permanently at top and bottom of the shaft or borehole.

8. The frames of drills and other electrical tools intended to be held in the hands while being operated should be grounded.

9. No potential higher than 250 volts should be used for operating drills or any other electrical tool intended to be held in the hands. Electric drills or other tools held in the hand should have the electric switch so constructed as to shut off the current when the hands release it.

10. Underground electric stations should be in rooms of fireproof construction. Fireproof doors should be provided and arranged to close automatically in case of fire. Electric stations include transformer installations, pumps, motor-generator sets, and charging stations.

11. Underground stations having transformers filled with inflammable oil should be provided with a door sill, or its equivalent, that will confine the oil to the room in case of leakage.

12. Clean, dry sand or rock dust and fire extinguishers, suitable from both toxic and shock standpoint, should be provided and placed outside of underground electric stations, so as to be out of the smoke of a fire in the station.

13. Underground storage battery charging stations should be placed on a separate air split.

14. Insulated mats or platforms should be used in front of all switchboards, and starting switches of all permanent underground electrical equipment.

15. Trolley and bare power wires should be:

(a) Securely supported on insulated hangers not less than 30 feet apart.
(b) Kept taut and not permitted to touch the roof, rib or crossbars, or door frames.
(c) Properly alined and placed at least 6 inches outside the rail.
(d) Located on opposite side from rooms and refuge holes and clearance side.

(e) Sectionalized by proper switches at intervals not exceeding 2,500 feet, and switches should be placed near the beginning of all branch lines.

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(f) Provided with sectionalizing switches at points where loaded mine cars are stored on idle days.
(g) Adequately guarded where the wire is less than 6-1/2 feet above the top of the rail.
(h) Adequately guarded and sectionalized at man-trip stations.
(i) Cut-off and fastened with an insulated turn-buckle at inby end.

16. In gassy mines, high voltage transmission cables should be of armored or other suitable type, and the armor should be electrically continuous throughout and effectively grounded.

17. Power should be disconnected when repair work is being done on electrical equipment, and accessories such as trailing cable, feed wire, trolley wire, switches, junction boxes, and the like.

18. Power wires should be properly guarded on both sides of all doors for a distance of at least 16 feet.

19. Power wires, other than trolley wires, should be properly insulated when passing through doors or stoppings; trolley wires should be protected from contact with doors or door frames.

20. Power wires, whether bare or insulated, should be supported on, or by well designed and installed insulators and not by nailing them on timbers, or similar slipshod methods.

21. The end of trolley or feed wires should not be extended beyond the last open break-through or crosscut and should be kept at least 150 feet from the end of pillars, workings, or any open, partly caved, poorly ventilated places.

22. Power should be cut off idle sections of a mine and cut off from the mine itself on idle days when feasible. This statement is not, however, intended to bar the use of properly fused branch lines for the operation of single units such as pumps if pump and surroundings are examined with flame safety lamp and found free of gas before cutting on branch line.

23. All underground electrical equipment should be provided with switches of safe design, construction, and installation.

24. All officials, haulage crews, electricians, and others connected with electrical maintenance should be instructed as to locations of cut-out switches.

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25. All cut-out switches should be marked legibly so as to be found readily in case of emergency.

26. Enough circuit-breakers should be provided to protect all power circuits. If they are automatic, they should be set so that the circuits cannot be overloaded; if they are hand-set, the handles should not be tied in place.

27. All underground electrical equipment should be protected against excessive overload by fuses or equivalent protective devices, of the correct type and capacity.

28. Wiring in underground structures should be insulated and installed properly.

29. Telephone connections should be provided from the surface to within a few hundred feet of all working sections of the mine and should be kept always available for service.

30. Telephone wires should be installed on the opposite side from power or trolley wires.

31. Telephone wires crossing power or trolley wires should be adequately insulated.

32. Telephones should have suitable fuses or be otherwise protected to prevent becoming charged in excess of the power used on the telephone system.

33. If track is used for the return circuit, both rails should be well bonded at every joint and cross-bonded at least every 200 feet.

34. Signal wires should not carry in excess of 24 volts.

35. Signal wires should be supported to prevent sagging or short circuiting by contact or otherwise.

36. In gassy mines permissible junction or distribution boxes should be used in making power connections at working faces.

37. Cables for portable or semiportable underground electrical equipment should be provided with fused nips, or taps, unless suitably arranged for connecting to permissible junction or distribution boxes.

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38. Temporary cable splicing should be made in a workmanlike manner, electrically continuous, mechanically strong, and insulated. With a defective cable, it is preferable to use a standby cable and send the defective cable to the shop for adequate, safe repair.

39. Cables with temporary splices should not be kept in service more than 24 hours.

40. Permanent cable splicing should be done in surface or underground repair shops by proper splicing and vulcanizing.

41. To prevent excessive heating, the trailing cables of equipment used in conveyor mining should be suspended in long loops, rather than tightly coiled.

42. Instructions in artificial respiration should be posted at every electric station and at or near the entrance to the mine.

43. All employees working with or around electrical equipment should know how to give artificial respiration.

44. A plan or map should be kept showing the location of all stationary electrical equipment and all permanent wiring.

45. Electric lights on the slope or shaft bottom should be on a separate circuit from the trolley circuit.

46. Lighting circuits should be fused safely and effectively.

47. Lighting wires should be supported by suitable insulators, connected to the trolley or power line with clamps, and should not be wrapped or tied about the stem or stud of trolley hangers.

48. The ground connection for lighting wires taken off the trolley circuit should be made to the track circuit.

49. Incandescent lamps should be placed so that they cannot come in contact with combustible material, particularly timber, caps, or posts.

50. Incandescent lights should not be used at or near any working face unless of portable permissible storage battery type.

51. Incandescent lamps on haulageways should be recessed in the roof or rib or shielded to prevent glare.

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52. Lamp sockets with exposed metal parts should not be used underground.

16. Control of Coal Dust and Rock-dusting

1. Coal dust should not be permitted to accumulate on roadways, along conveyor lines, and on gob, rib, roof, or timbers.

2. If machine cuttings are of a character that would contribute to an explosion, they should be loaded out; in general, it is desirable that any machine cuttings containing coal should be loaded and hauled out of the mine.

3. Coal should not be used for track ballast.

4. Mine cars should be constructed and maintained dust-tight.

5. Coal should be so loaded that it will not spill off during transportation.

6. Water or wetting solutions should be used for allaying coal dust:

(a) On the cutter bar or cutting chain of mining machines, or sprayed on the dust as it emerges from the kerf.
(b) Before and after blasting.
(c) On the coal pile before and during loading, if hand-loading into car or on conveyor is done.
(d) On the coal pile before and during loading, if loading by "duckbill" or scraper.
(e) On mobile loading machines.
(f) At the unloading head of conveyors or scrapers.
(g) On loaded and empty trips.
(h) In the face region and back to the last application of rock dust.
(i) At underground dumps.

7. All coal mines, except anthracite mines (whether in wet or dry condition), should be kept thoroughly rock-dusted, in all open, unsealed places to at least within 40 feet of the face. The dust should be distributed upon the top, bottom, and sides.

8. Loose coal and coal dust should be cleaned up before applying rock dust.

9. Rock dust should be applied and maintained in such quantity that the incombustible content will not be less than 65 percent.

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10. When methane is present in the ventilating current, the 65-percent minimum percentage of incombustible should be increased 1 percent for each 0.1 percent methane.

11. Sampling should be done monthly to determine whether redusting is needed.

12. A record should be kept showing the location of the places of sampling, the results of the analyses, and the amount of rock dust applied monthly as well as annually.

17. Haulage

1. Haulage roads should be kept clean of coal spillage, coal dust, and debris.

2. Rails should be of sufficient weight to carry safely the heaviest rolling stock and should be firmly attached to ties of adequate size, number, and spacing.

3. On all haulage roads, rail joints should be plated or welded and be well supported by ties placed immediately under the joints.

4. The track should be properly alined and should be free from high or low joints, broken rails, defective switches, defective frogs, and defective frog alinment.

5. Road bed should be kept well drained and surfaced.

6. Frogs and guard and lead rails should be well blocked.

7. Switches should be complete with parallel throws and bridle bars.

8. The rod extending from the rail to the switch throw should be covered or otherwise protected.

9. Switch throws should be placed on the clearance side.

10. Incandescent electric lights should illuminate all switches located in pure intake air.

11. Internal combustion engines for driving locomotives, pumps, etc., should not be used underground.

12. Steam locomotives should not be used underground.

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13. Where two or more locomotives are operating on the same track, a block or telephone signal system should be used to control movement of locomotives. This should not be construed as preventing use of locomotives in tandem or the use of more than one locomotive with one trip.

14. Pushing of cars should be eliminated insofar as possible; trips should not be pushed on main haulageways except at partings or under some emergency.

15. Sprags, chains, or car blocks should be used on all standing cars regardless of grade. If cars have brakes, they also should be set.

16. Use of chips or small pieces of wood, pieces of coal or rock or similar makeshifts should not be considered as adequate blocking.

17. An effective drag, or equivalent positive mechanical device, should be used on all trips ascending grades in excess of 3 percent.

18. On all inside slopes and planes having a knuckle, there should be a positive action safety block at or above the knuckle.

19. A positive stop block, or derail, should be placed below the switch of the first active working place on all producing entries going to the rise.

20. On producing entries going to the dip, a positive stop block or derail should be placed just above the switch to the first active working place and a stop block should be placed just below the switch to the last active working place.

21. When coal is not being loaded in a room or entry face and, nevertheless, men are working therein, a positive stop block or derail should be placed across the room or entry track to prevent cars inadvertently from being pushed into place.

22. Slides or skids should be used on descending grades where locomotive is not adequate to control trip.

23. Each locomotive should have an efficient headlight and gong or other effective signal.

24. Locomotive headlight bulbs should not be supported by waste or other combustible material.

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25. An efficient trip light should be placed on the rear of all trips and on the front of cars being pushed. Permissible type trip lights should be used in gassy mines. Reflector buttons should not be substituted for trip lights.

26. On all trolley haulageways there should be a continuous clearance on the side opposite the trolley wire of at least 30 inches from the nearest obstruction to the farthest projection of moving equipment.

27. On the trolley wire side, there should be a clearance of at least 12 inches from the nearest obstruction to the farthest projection of moving equipment.

28. At side tracks there should be a clearance of at least 30 inches between the farthest projection of equipment on any two tracks.

29. Shelter holes should be available along all haulageways; they should be suitably marked and not over 60 feet apart on the clearance side, not more than 4 feet wide and not less than 5 feet deep, and 6 feet in height or as high as the traveling space if it is less than 6 feet.

30. Shelter holes should be kept clean and free from loose material, and other obstructions.

31. Room necks and crosscuts complying with the above standards should be considered as shelter holes even though wider than 4 feet.

32. Shelter holes should be made at all switch throws.

33. Shelter holes should be provided on both sides of all doors.

34. Clearance should not be obstructed by loose rock or coal, supplies, or other material.

35. Only authorized persons should operate locomotives.

36. Locomotives and cars should be handled carefully and kept under control at all times.

37. A system of signals should govern movement of trips.

38. Riding on locomotives should be prohibited except to those operating the trip and persons authorized by management.

39. Riding on top of loaded cars, between cars, on trolley wire side of cars, or on bumpers in front of cars should be prohibited. Riding on outside of cars should be prohibited, except to those operating the trip.

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40. Motormen or brakemen should not get on or off cars or trips in motion.

41. When the motorman leaves the locomotive temporarily, the reverse lever on the controller should be set at neutral, and brakes set tightly; if the lever is removable, it should be removed.

42. Backpoling should be allowed only at places where trolleypole cannot be reversed and at very slow speed of locomotive.

43. "Nipping" should not be permitted.

44. Flying switches should be prohibited.

45. At least two cars should be placed between the locomotive and cars or trucks carrying rails or long timbers.

46. An interval of at least 500 feet should be maintained between locomotives traveling in the same direction; and the locomotives should be held to a low speed.

47. Cars should not be coupled by hand while they are in motion.

48. Cars should not be coupled by hand from the inside of curves.

49. Locomotives approaching and passing through doors should be operated at reduced speed for at least 100 feet on each side of the door.

50. Locomotives should be equipped with suitable rerailers, jacks, and other necessary tools for rerailing cars or locomotives.

51. Short pieces of rail, ties, or props should not be used to raise or slue derailed cars and locomotives.

52. Cars and trips should not be left standing in a place where they will endanger other trips or persons.

53. Motormen, brakemen, and drivers should not leave ventilating doors or curtains standing open while placing or gathering cars.

54. Cars and trips should not be left standing where they may obstruct the ventilating current.

55. Man trips should be in charge of an official who should accompany the trip.

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56. The speed of man trips should not exceed 6 miles per hour. Man trips should be under the control of the motorman at all times.

57. Man trips should not be operated behind loaded trips on ascending grades, nor in front of loaded trips on descending grades.

58. Enough cars should be provided on man trips to permit all men to ride inside and prevent crowding.

59. Men on man trips should not ride in the car next to a trolley locomotive.

60. When riding in a car on a trolley haulage road, men should ride on the side of the car opposite the trolley wire if there is any danger of men coming in contact with trolley wire.

61. No person other than brakeman should be permitted to ride on the rear bumper of a man trip, and no person should be allowed to ride between cars.

62. The man trip should come to a full stop before men load and unload.

63. A suitable place with seats should be provided at junction points where men may congregate while waiting for man trip; it should be where lives of persons waiting would not be jeopardized by a runaway car or trip or the wrecking of car or trip.

64. No material except tools and other supplies that can fit inside a separate car should be hauled on the man trips; no explosives should be carried on the man trip.

65. A car should be provided for tools and tools should not be permitted in the man trip in any car with men.

66. At man trip loading and unloading stations, the power should be cut off the trolley wire while men are loading or unloading; also the wire should be adequately guarded at those stations.

67. All haulage employees and others who work around machinery while wearing electric cap lamps should conceal the cables of their lamps under their clothing and should wear tight-fitting clothes with trouser legs in boots or puttees, or otherwise fitted snugly.

68. Haulage equipment should be maintained in safe condition.

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69. Room hoists should not be worked beyond their capacity; their ropes should not be used to replace derailed cars; and the rope should be attached or coupled only to the drawbar of the car.

70. When a room hoisting rope has a broken strand, it should not be used until repaired.

18. Timbering

1. Systematic timbering rules and outlines should be provided.

2. Timbering rules should be strictly enforced.

3. An adequate supply of props, timbers, and prepared cap pieces and wedges should be provided at places convenient to faces or other point of use.

4. Miners and other face employees should examine their working places thoroughly and make them safe before beginning work.

5. Every underground worker should be instructed in the vibration method of testing roof.

6. Exposed roof in every working face should be tested at frequent intervals when workers are at or near the face.

7. Mining-machine and loader operators should be provided with suitable roof testing bars, and should test roof and sides, and any dangerous condition should be remedied before operation is begun. The machine should be stopped while roof and sides are being tested.

8. Officials should test exposed roof in working places visited and roof along haulageways and manways with a special roof testing rod; condition of timbering should also be observed.

9. Loose coal, slate, or rock in haulageways and manways should be removed or supported securely as soon as practicable.

10. Overhanging ribs or brows should be taken down or supported effectively.

11. Before taking down loose roof a careful examination should be made of the adjacent roof, and if the conditions in any way warrant it a temporary post or posts should be set first.

12. If loose slate or other roof material is being pried down a bar not less than 4 feet long should be used instead of a pick.

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13. Where conditions make it at all practicable to use a safety post this post or posts should be set before coal loading is begun.

14. Before safety posts are removed a careful inspection should be made of the roof and, where necessary, additional timber set. If any safety posts are removed before additional timber is set a long bar or rail rather than a hammer or axe should be used in removing posts.

15. Where there is danger of coal rolling upon a person it should be spragged after undercutting or center-cutting, by placing blocks in the cut, not over 4 feet apart, or by blocking with leaning posts.

16. In slopes or inclined shafts and in main haulageways, posts supporting the roof or sides should be hitched into the rib or wall. If this is not practicable, substantial guard rails should be placed along or spacers between the posts.

17. No post should be set without an adequate cap piece.

18. Cap pieces should be at least 18 inches long, 3 or more inches thick, and at least as wide as the top of the post, and where practicable, should be made of soft wood.

19. In hand-loading places where permanent crossbars are required, temporary timbers should not be extended more than the distance of one "cut" of coal beyond the last permanent crossbar.

20. In mechanical loading places where temporary crossbars are required to be set close to the face, such temporary crossbars should not be removed until permanent crossbars have been set to replace them; no more than two "cuts" of coal should be removed beyond the last permanent crossbar.

21. Miners or other employees should not go under draw slate or other loose roof material until it is made safe.

22. Broken and rotten timbers should be replaced as soon as possible.

23. Timber removed by cutting-machine or loading-machine operators or timber knocked out by shooting should be replaced as soon as possible.

24. Timbers should be recovered only by mechanical means, by men experienced in such work and under the direct supervision of an official.

25. In pillar work, breakline posts or cribs should be maintained at all times at the loose ends of pillars and stumps.

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19. Safety Organization

1. A safety engineer or director should be employed for mines employing 100 or more persons.

2. In mines employing 100 or more persons, the safety engineer or director should have no duties to perform other than looking after the safety of the employees. He should report to the higher officials (general superintendent, general manager, or president) and should have authority to correct unsafe conditions where the hazard is great; otherwise he should call attention of officials to the hazards.

3. In small mines (those employing fewer than 100 persons) an official such as foreman, assistant foreman, face boss, etc., may also serve as the safety engineer or director.

4. A safety organization of officials and employees should be established.

5. Joint safety meetings of men and officials should be held at least monthly.

6. A bulletin board and suitable bulletins should be provided and the bulletins should be changed from time to time and kept interesting and up-to-date.

7. All accidents should be investigated and a record kept of such investigations.

8. Responsibility for accidents should be placed when it is feasible to ascertain such responsibility.

9. When feasible, a safety committee, including workmen and officials, should make periodic inspections of the mine and submit recommendations for correcting hazards observed.

10. A record should be kept of all lost-time accidents, and they should be summarized monthly as well as annually and studied with a view to making needed corrections in practice.

20. First Aid and Mine Rescue

1. All employees (underground and surface) should be given first-aid training as soon as possible after being employed.

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2. Where feasible, additional first-aid training should be given all employees annually.

3. Adequate first-aid material should be provided on the surface and underground, and kept in clean, usable condition.

4. A selected number of men should be trained in mine rescue work, at least 12 men for any mine employing more than 100 men whenever such training facilities are available.

5. Additional mine rescue training should be given monthly if training facilities are available.

6. Mine officials should take the Bureau of Mines Advanced Mine Rescue Course when such course is available.

7. Mine rescue equipment should be provided if the mine does not have access to State-owned equipment or is not a member of a central rescue station.

8. Underground employees should have self-rescuers.

9. If employees have self-rescuers, they should be trained in their use and self-rescuers should be tested at frequent intervals by immersion in hot water.

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